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## **Title**

*Researchers and teachers learning together and from each other using video-based multimodal analysis*

**Jacob Davidsen and Ruben Vanderlinde**

## **Abstract**

This paper reports on a year-long technology integration project during which teachers and researchers joined forces to explore children's collaboration supported by touch-screens. In two classrooms, 16 touch-screens were integrated into teaching and learning activities; the process was captured using video equipment and more than 150 hours of footage were collected. With the aid of digital research technologies and the longitudinal collection of video data, it was possible to study how the children and teachers gradually integrated the touch-screens into their learning and teaching. The primary agenda of this paper is to critically reflect on the methodological aspects of video-based multimodal analysis by outlining and discussing how researchers and teachers can study children's touch-screen supported collaboration. Secondly, the paper describes and reflects on how researchers and teachers learned together and from each other in the exploration of children's collaboration supported by touch-screens, using video-based multimodal analysis.

## **Introduction**

Collaborative research projects, where teachers and researchers join forces in the exploration of a practice, have been seen as a way to bridge the gap between educational research and educational practice (Wagner, 1997; Vanderlinde & Van Braak, 2010). According to Broekkamp and van Hout-Wolters (2007), the gap consists of four interrelated problems: 1) educational research yields few conclusive results; 2) educational research yields few practical results; 3) practitioners believe that educational research is not conclusive or practical; and 4) practitioners make little (appropriate) use of educational research. In addition, Vanderlinde and Van Braak (2010, p. 306) identified several critical points that might cause a gap between research and practice, for example that "researchers speak and write in a language that is unintelligible to practitioners". In this paper, we argue that video-based multimodal analysis of micro level interactions can function as a tool for researchers and teachers to collaboratively explore a practice. Using a video-based multimodal analysis, we aimed to show how language, body and material are part of children's complex negotiation of meaning. As highlighted by and Rowe (2012), classroom research has tended to value language at the expense of embodied ways of meaning making. More precisely, researchers have studied classroom talk and dialogue, but have neglected the multimodal and embodied dimensions of classroom interaction (Jewitt, 2008). We argue that a video-based multimodal analysis can shed light on micro level classroom interaction, and more importantly, provide researchers with a tool for engaging teachers as co-researchers. This argument is provided by critically and analytically presenting a research project wherein teachers and researchers collaboratively analysed and interpreted children's interactions in front of a shared touch-screen, using video-based multimodal analyses. The paper outlines and discusses two methodological challenges: 1) how researchers and teachers can study children's touch-screen supported collaboration and 2) how researchers can involve teachers as co-researchers in exploring the benefits and limitations of touch-screens in classrooms. To sum up, this paper critically portrays the methodological challenges of a year-long technology integration project in two primary education classrooms by presenting the methodological tools used in video-based multimodal analysis and discussing how researchers and teachers engaged in a mutual learning partnership.

## **Presenting the research project**

Project “Move and Learn” had an overall focus of exploring how touch-screens can support collaboration, interaction and experimental forms of learning in classroom settings (Davidsen & Georgsen, 2010; Davidsen & Christiansen, 2013). Overall, this research project was characterised by its intense practitioner–researcher relationship and the variety of different technologies and methods used to investigate how the children’s collaborative actions unfolded. Basically, information and communication technologies (ICT) was applied in three ways: first, as a tool for children’s collaborative learning; second, as a tool for researchers to collect, analyse and present data; and third, as a tool for informing teachers’ understanding of their own practice, using video-based multimodal analysis.

### *ICT as a tool for children’s collaborative learning*

During the course of a full school year, 41 children, three teachers, and two researchers participated in a technology integration project at Western State School (WSS) in Denmark. Names of the school, teachers and children have been changed. In two classrooms, 16 single-touch screens with 23 inch large screens were integrated into the daily teaching and learning practice. In this setting, eight- and nine-year-old children worked together on different tasks, supported by the touch-screens. The children worked with texts, diagrams and pictures in pairs or groups of three, and produced multimodal stories in subjects including math, Danish and religion. The physical arrangement of one of the two classrooms is illustrated in Figure 1, which shows that the arrangement supported many places to learn, with the teacher taking a less central position in the classroom.

*Figure 1: Classroom overview*

The teacher would walk from one pupil workspace to another, guiding the pairs with technical, social and subject-related matters. To sum up, the technology integration project at the school was characterised by its innovative application of ICT for children’s collaborative learning.

### *ICT as a tool for research*

This research project was characterised by the application of a variety of digital technologies, such as video footage, photography, online timeline logging - a shared webpage for registration of events, blogging - teachers sharing experiences from the project on a public blog -, digital learning materials and teachers’ audio logs about the children, all of which supported the production of a rich and longitudinal dataset. Video footage was the primary technique employed, and to establish how the children were working together, cameras were placed in stationary positions above a pair in front of the touch-screens (see Figure 2). Small web cameras with external microphones were selected (see Figure 2) to minimise their presence and level of disturbance in the classroom (Jordan & Henderson, 1996). However, the children oriented themselves towards the cameras throughout the project, especially during the first couple of months, making funny faces or asking questions about who was watching them. The children gradually forgot about the cameras and acted “naturally”. In that sense, the observer effect (Hawthorne effect) decreased as a consequence of the year-long project. We decided to use a simple user interface - a laptop with Moviemaker™ - as the teachers were responsible for starting and stopping the recordings as one of their numerous tasks in the classrooms.

*Figure 2: Web camera position*

After a couple of months, the research team decided to install another fixed camera to capture the wider classroom environment and improve the understanding of the overall activity and atmosphere. The researchers also regularly used a handheld, pocket-sized camera to record the children's interactions or when interviewing the children while they worked together. The process of collecting the more than 150 hours of video footage during this project was a shared effort between teachers and researchers.

The next step in the process of working with video footage was to organise and get an overview of the video data. After collecting the video footage and the other digital materials, the researchers began systematising and organising it. For this purpose, the researchers used Transana (2013), a software tool for transcribing and coding audio-visual footage. Each video file was assigned date, time, subject and names of the children and teachers. Then, the video footage was watched, and every situation where a teacher guided a pair was coded as "supervision" and the character of the supervision eg. technical, social, academic. On this basis, it was possible to generate collections of clips in Transana depicting a specific type of supervision, pair, and teacher eg. technical supervision of pair x by teacher y. This technique resulted in a collection containing 248 situations in which teachers guided pairs from one of the classrooms. The coding and systematisation of the data corpus offered some general perspectives on the interaction patterns in the classrooms, but a more detailed, **micro** and multimodal perspective was required to study how the children engaged in and learned to collaborate in this touch-screen environment. In other words, the coding of the data was not based on quantitative goals, but on generating collections of clips with some **similarity**, for video-based multimodal analysis. Hence, we transcribed an extensive part of the video footage in Transana, but experienced some difficulties in transcribing the different semiotic resources in the children's embodied interaction e.g. the complex between hand movements, body position, talk and the material at hand.

On a general level, the methodological foundation for transcribing and analysing the children's embodied collaborative interactions originates in traditions such as conversation analysis (Goodwin, 2000; Streeck, Goodwin & LeBaron, 2011), interaction analysis (Jordan & Henderson, 1995) and multimodal analysis (Norris, 2004). The theoretical assumptions underlying the concept of embodied interaction (Dourish, 2004; Streeck et al., 2011) emphasise an orientation to a more bodily understanding of human interaction. This theoretical lens considers movement of the body in interplay with language and material, which helped us provide a **micro-level** and multimodal understanding of interaction in the classrooms. Hence, such a transcription of children's embodied collaborative interaction should encompass the interplay among the semiotic resources eg. language, gestures and materials. For this type of transcription, we worked in ELAN (2013). Compared to Transana, ELAN offers a more detailed transcription platform for studying interaction, and thus, it was possible to study the interplay among the different semiotic resources in action. ELAN offers a frame-by-frame segmentation and transcription of video, which means that we can track, for example, how one child moved her hand towards the screen, if she paused, if she stretched out her index finger, or if her partner interfered and pushed her hand away. As shown in Figure 3, we transcribed the semiotic resources in separate "tiers" in ELAN eg. speech, left and right hand movement:

*Figure 3: Transcription tiers in ELAN*

In order to focus on the children's gestures, body movements, pointing, touching and pushing at the screen, we decided to transcribe these actions without sound initially to circumvent the focus on the "audio channel". Following Rowe (2012), researchers with a multimodal approach should focus on embodied ways of meaning making, not just the "audio channel". Thus, transcribing without sound "magnified" the children's gestures and served as a starting point for analysing their embodied collaborative actions. Along with the transcribed dialogue, it was possible to trace and study how the children interacted with the touch-screen and related to each other's talk, gestures and manipulation on the screen. It was also possible to scrutinise, for instance, pauses in their interaction, overlaps and breakdowns, such as how the children acted when the computer responded in unpredictable ways or how they gave and took turns throughout a sequence with the semiotic resources present. To demonstrate how the children actually interacted with the touch-screens, we produced a multimodal transcription (see Figure 4).

*Figure 4: Multimodal transcript of the children's embodied collaborative actions*

A multimodal transcription such as this served as the analytic unit for the researchers' and teachers' mutual exploration of the children's collaboration supported by the touch-screens.

#### *ICT as a tool for informing teachers' understanding of their own practice*

As an overall goal, the researchers tried to engage in a close relationship with the teachers, building on principles of mutual respect, trust and learning (Nielsen, Dirckinck-Holmfeld & Danielsen, 2003). Overall, this can be referred to as a co-learning agreement (Wagner, 1997) between researchers and teachers, with a basic intention of developing a mutual understanding of the potentials and challenges of integrating touch-screens as a tool for children's collaborative learning. The teachers led this exploration, while the researchers followed the process of the project from the side-lines. In other words, the researchers did not design any experiments or interventions for the teachers and children to work with. However, the researchers' general interest in collaboration might have influenced the teachers' design of learning materials and their guidance of the children's collaboration. Video footage was the primary tool utilised in the research project, but to triangulate these observations, a variety of related methods were applied. These tools were classroom observations, interviews and informal conversations with teachers, children and parents, and especially in so-called video feedback sessions with the teachers. The teachers and researchers collected all major events in an online timeline log e.g. the teachers noted special learning themes, maternity leaves, substitute teachers and visits from outsiders. As an example, one of the teachers was sick and was substituted for one week, and in the period afterwards, the children were more disruptive than usual. In this situation, the shared webpage with the online timeline log provided contextual and historical information, which supported the analysis of the clips from that particular period. The teachers also posted their reflections about the positive and negative experience of being part of the project on a public blog.

In the video feedback sessions, the teachers and researchers met in one of the two classrooms and viewed video clips and multimodal transcripts together. These were crucial activities, as they facilitated both mutual learning and dialogue about the practice based on the transcribed micro-level interactions. The video feedback sessions were also recorded and transcribed in Transana. The video feedback sessions typically lasted two hours, beginning with a short introduction about the arrangements of the activity. For each session, the researchers prepared two to four, five-minute video clips from the data material. While the researchers selected the clips and prepared the multimodal transcripts, the teachers conducted the analysis of the video clips. The researchers decided to show the video clips without the transcripts at the first viewing, to get the teachers'

spontaneous reactions and reflections on the children's activity. After this first viewing, the teachers analysed the clip and discussed how the children engaged in the collaborative activity. After this initial discussion of the video clip, the multimodal transcripts were distributed and the teachers watched the video again. The repeated viewings served to increase the possibility that "previously invisible phenomena become apparent and increasingly deeper orders of regularity in actors' behaviors reveal themselves" (Jordan & Henderson, 1996). The video feedback sessions also added what Tracy (2010) described as "members reflections", which serve as a basis for credibility of qualitative and interpretative research. In other words, the teacher's reflections on the children's collaborative actions were important in qualifying the researchers' continued analysis and interpretations. These video feedback sessions allowed both the researchers and teachers to act as narrators and translators in analysing the video data. In essence, showing the teachers short video clips of the children's interactions with the touch-screens provided them with a new perspective on their everyday practice. **Essentially, this approach was innovative as it involved teachers in looking at learning related video materials on a level of micro-interactions, which they might otherwise not had been aware of, given the information load in a classroom lesson. This level is important on theoretical level as it sheds light on processes that matter for learning.**

Using the transcripts of the video feedback sessions, we identified three recurring themes: "seeing collaboration", "participation in video feedback sessions", and "meta-reflection". Some of the themes discussed in relation to seeing collaboration were: children's body movements and positions as an expression of the status of the collaborative activity; effects of the teacher's presence on the children's engagement in the collaborative activity; effects of composition of the pairs on collaborative activity; and children's ICT competences as shown in their off-task activities. For instance, during the first video feedback session, one of the teachers said that she normally would assess a pair on their progress, but now she could see that task progression had nothing to do with the status or history of the collaborative activity.

After analysing the children's collaborative interactions, the teachers reflected on methodological aspects of the video feedback sessions. For instance, they discussed the importance of having the multimodal transcripts for the analysis, that viewing the video clips several times revealed new patterns and findings, and that the video clips showed them some of the underlying patterns in the classroom, such as how the children actually engaged in collaboration.

On a meta-reflective level, the teachers discussed the importance of talking with the children about what it actually means to engage in a collaborative activity supported by technology. They discussed how they could use the video feedback sessions for reflection and redesign, ie. they were implementing new interventions in their own practice. They also talked about why they even wanted the children to learn to collaborate. In other words, they discussed what collaboration looks like and how to facilitate it. Finally, they talked about the importance of having support from school management for engaging in projects like this.

From a researcher's point of view, the video feedback sessions were an important argument for the teachers to continue collecting video footage in the classrooms, because it became clear that such footage could inform their understanding of their own practice. These sessions also provided teachers and researchers with the opportunity to construct pedagogical ideas and reach tentative conclusions about the potential and challenges of touch-screens as a tool for children's collaboration. The quote below, from the public blog, sums up one teacher's experience with taking part in the video feedback sessions (translated from Danish to English): "As a teacher, it was really inspiring to get the children's work served from a whole new perspective. Being able to follow their collaboration, dialogues, conflicts and workflow, for better and worse was something we could use. I have never received such good feedback on my teaching before this afternoon, and it provided me food for thought. The video material made it clear that we by far discover everything that goes on in



the classroom. That we of practical reasons run around the room and do not always get the right picture of a situation.”

To sum up, the teachers reflected on and began revising their actions and designs after the video feedback sessions. Furthermore, they carried out some of the researchers’ interpretations and added important contextual cues and information about the learners and activities. The teachers expressed that they would have liked to continue having these sessions, and further, that they would like the researchers to bring more transcripts and video clips. One of the teachers even thought of involving the children in similar sessions so they could see how they actually acted together.

## Discussion

The findings and methodological lessons learned in this research project are framed within an overall scope of video-based multimodal analysis of micro-level interactions. The video-based multimodal analysis supported by ICT played an important role in cultivating the researchers’ understanding of both the teachers’ and children’s actions in the touch-screen environment. Put differently, the application of ICT in the research process, and the methodological orientation towards understanding how the children negotiated meaning in situations, supported a practical and concrete focus on the children’s and teachers’ actions, instead of labelling their actions from abstract theoretical perspectives.

Based on this study, we suggest that educational technology researchers in general, and those focusing on collaboration in technology-rich classrooms specifically, apply video-based multimodal analysis in all phases of their studies. This method provides an opportunity for researchers and teachers to obtain a detailed and multimodal understanding of how children work together and collaborate supported by touch-screens. When utilising a video-based multimodal analysis, researchers are afforded a holistic, micro-level and embodied perspective on human actions that is unavailable when using more traditional research designs (Rowe, 2012). Interviews and surveys complement a video-based multimodal analysis; however, as Blomberg, Giacomini, Mosher, and Swenton-Wall (1993) wrote about the “say/do problem”, people’s actions and their stories of their actions are never the same. To make it clear, seeing what people do in a video-based multimodal analysis provides a different picture than asking them what they did – in particular, it illuminates processes that matter to learning in theory and practice. Consequently, the argument for examining a practice using video-based multimodal analysis is strengthened by the fact that this type of research can provide practitioners with useful knowledge from and about their work eg. showing teachers micro-interactions they might otherwise not would have been aware of, given the information load in classrooms. This knowledge can become useful in many aspects of their practice, such as improving future learning designs. These contextual and situated perspectives are arguably difficult to generalise at a policy level, but the experience from this research project shows that multimodal analyses are more concrete and situated, and therefore, act as illustrations and examples for future teaching and collaborative learning activities with ICT. Another reason for integrating technological tools into the research design is that researchers and teachers are able to trace the children’s learning over time and across different activities. With such a massive amount of data collected over a long period of time, it is important to remember that such longitudinal studies, which involve large datasets, demand contextual information, such as the setting and the participants. As stated previously, there is a danger that such a substantial amount of data will be chaotic to systematise and organise, and therefore, it is important to keep track of the recordings and add contextual cues throughout the entire data collection process. In other words, the video feedback sessions, together with the online timeline logging and blogging, provided important contextual and historic cues that support the continued analysis.

In spite of the teachers' positive attitudes towards collecting and analysing video footage, they did not continue this activity on their own after the project ended. Although they talked about the opportunity to organise a video session they never realised it. Nevertheless, this has nothing to do with a lack of interest, but simply a matter of prioritising their teaching time. It seems that the researchers' facilitation and preparation of video clips and multimodal transcripts was crucial for the teachers' engagement in the video feedback sessions. However, the descriptions of this process, as presented in this paper, should enable other researchers to engage in collaborative research activities with teachers using video-based multimodal analysis.

## Conclusion

By critically sharing experiences and reflections on how ICT supported and augmented the longitudinal research process during this project, this paper adds to the literature in two distinct ways. First, it illustrates that digital research and video-based multimodal analysis can bridge the gap between educational researchers and practitioners, particularly through using concrete, **micro-level** and situated video examples. Essentially, such a research design can support the process of mutual learning between researchers and teachers. Second, ICT and a video-based multimodal analysis highlight how teachers can facilitate children's collaboration in a technology-rich classroom. In this project, the video clips and multimodal transcripts opened both the researchers' and teachers' eyes to a more embodied understanding of collaboration **theoretically and practically**.

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